

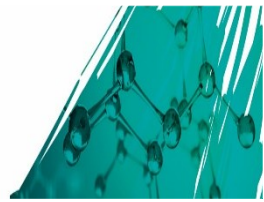


BTEC Assignment Brief

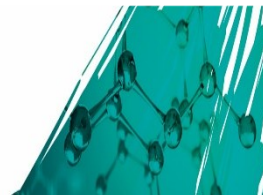
Qualification	Pearson BTEC International Level 3 Subsidiary Diploma in Applied Science Pearson BTEC International Level 3 Foundation Diploma in Applied Science Pearson BTEC International Level 3 Diploma in Applied Science Pearson BTEC International Level 3 Extended Diploma in Applied Science
Unit number and title	Unit 18: Astronomy and Space Science
Learning aim(s) (For NQF only)	C: Investigate the essential factors involved in space flight D: Understand the fundamental concepts outlined in astrophysics and cosmology.
Assignment title	'The Final Frontier'
Assessor	
Issue date	
Hand in deadline	

Vocational Scenario or Context	As part of an international exchange programme, you have secured a prestigious placement on the NASA 'Applied Physics Laboratory Internship Project' for college students. This is a 10-week, summer internship at the John Hopkins University Applied Physics Laboratory, for students interested in civil and/or defence space projects. You have been asked to produce two reports. The first is on the theory and evidence for the origin and end of the Universe, the lifecycle and characteristics of stars and the second report is on the conditions needed to achieve manned and unmanned space flight.
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Task 1	Produce a report, containing two sections, to demonstrate your understanding of astrophysics and cosmology. <u>Section 1: The lifecycle and classification of stars</u> Explain the life cycle of stars, from formation through to evolution and eventual "death", using current knowledge and theories. Produce a clearly labelled diagram to support your explanation, which will reference: • Star creation (formation from nebulae, internal temperature rise, initial nuclear reactions and pressure balance, protostars) • Main sequence, with stages and star types relating the mass of the star to its life cycle (e.g. average star, massive star) • Eventual end (i.e. mass equal to our Sun, mass greater than our Sun; core collapse; red giants; white dwarfs; neutron stars; pulsars; stellar spectral energy distribution; temperature electron-degenerate matter; Chandrasekhar limit; supernovae; black holes; accretion disc; event horizon; Schwarzschild radius; singularity.) Produce a fully annotated Hertzsprung-Russell (H-R) diagram, and explain its use as a tool for astronomers to predict the history and evolution of stars. Include physical and chemical characteristics of
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	size, mass, magnitude, radiation, temperature, luminosity and spectral class, and the causes of these properties. Explain how the difference in initial mass of material leads to variation in a star's evolution. Select named examples of three different types of star and assess the stage of each in their life cycle. Your selection will be in relation to each star's mass compared with our own Sun (i.e. mass equal to, greater than and less than the Sun). Base your assessment upon evidence from physical and chemical characteristics, information on pressure balance and imbalance and other data. (You may also refer to your research for our own Sun in the previous assignment "The Solar System"). <u>Section 2: The Universe</u> The 'Big Bang' is the most dominant theory of how the Universe was created and indicates how the Universe may end. Describe and explain 'the Big Bang theory', using evidence from observed phenomenon to support its validity. Your work should include: Hubbles Law, the composition of the universe including matter, dark matter and dark energy, redshift and absorption of wavelengths, cosmic microwave background (CMB), the abundance of hydrogen and helium isotopes, composition of the Universe and a brief outline of <i>Olbers' Paradox</i>. You may need to refer to other important aspects in your explanation such as: astronomical distance measurement (astronomical unit, light year, parsec), use of trigonometric parallax and its limitations, Cepheid Variables, brightness variation and eclipsing binaries Your explanation of evidence should extend to the formation, classification and movement of galaxies, quasars, the formation and destruction of stars and the age of the Universe. Link this work to a discussion on whether life on Earth may be 'unique', the probability of life elsewhere in the Universe and difficulties of space travel beyond our solar system.
Checklist of evidence required	A written report which includes: • An explanation of the lifecycle of stars • Star characteristics linked to star formation, main sequence and death, and a detailed Hertzsprung-Russell (H-R) diagram • An explanation of the current theories and evidence of the origin through to the anticipated end of the Universe • An outline of principles of measuring distances in space (as part of Hubble's experiments)
Criteria covered by this task:	
Unit/Criteria reference	To achieve the criteria you must show that you are able to:
D.M4	Assess the processes of star formation, their life cycles and evolution
D.M5	Explain the evidence linked to theories of the evolution of the universe related to observed phenomenon and its composition
D.P6	Explain current knowledge and theories of the life cycle of stars
D.P7	Describe the evidence linked to theories of the evolution of the universe
Task 2	Produce a detailed report investigating the main factors involved in achieving space flight (manned and unmanned), the benefits it brings to society and what the future holds for space exploration and research. Your report should include:



	• Identify and describe what aspects need to be considered to put an object or and person(s) into space, Earth orbit and to other solar system bodies such as the Moon. Explain the factors that have to be considered to achieve space flight (materials, fuels, escape velocity, hazards, costs, communication) and develop a <i>case study</i> which focusses on issues faced by NASA when training astronauts for the Apollo missions. • Assess, in detail, the main factors in achieving and sustaining space flight by using available launch and flight data to explain how a spacecraft achieves escape velocity and maintains an orbit. Include escape velocity calculations in your report and mention of 'gravity assist'. Highlight the dangers involved with reference to known accidents (eg. Salyut 1, Apollo 1 and space shuttles Challenger and Columbia) • Explain the issues involved in preparing astronauts for space flight and the effects on <i>humans</i> of space flight in general. You must consider; radiation exposure, micro-gravity environment, astronauts in constant free-fall, physiological/physical effects and what can be done to limit problems, such as osteoporosis, change in blood flow and drop in plasma levels. Outline at least 5 products developed as a consequence of space flight and assess their benefits to industry, science and society. This could include the areas of health and medicine, transport, public safety, industry, computer technology, consumer use, environmental and agriculture. You should identify research work performed by astronauts in space for science and industry and its relevance to society. Select a range of planned manned and unmanned missions to space, proposed by various countries and organisations, for example: • The International Space Station and its decommission • Proposed interplanetary manned missions, e.g. Inspiration Mars, Mars landing, Orion • International unmanned missions e.g. SOLO, Juno, Mars Exploration Rover • International missions e.g. by Russia, China, Japan, European Space Agency • Space Tourism e.g. Spaceship 1, Genesis 1 space hotel, considerations of water purification, food, near weightless conditions, astronaut relationships, time and psychological aspects, problems of space debris and the role of the Inter-Agency Space Debris Committee (IADC) For each mission you select, give a clear description of the proposed mission and an evaluation of the developments of each programme in terms of cost, difficulties faced, benefits, and other implications including the future of space flight, space exploration and research.
Checklist of evidence required	A report which includes: • An explanation of how space flight is achieved and sustained by investigating the factors to be considered and an



	assessment of the main issues involved in astronaut training through a case study of the Apollo missions • An appraisal of the dangers involved in space flight, both accidental and from working in the conditions of space • An assessment of the benefits of space flight for science and industry • An evaluation of the future of space flight, space exploration and research through three case studies of planned space missions.
Criteria covered by this task:	
Unit/Criteria reference	To achieve the criteria you must show that you are able to:
CD.D3	Evaluate the future of space flight and space exploration and research.
C.M3	Assess the main factors and benefits associated with achieving space flight for manned and unmanned exploration.
C.P5	Explain the main factors associated with achieving space flight for manned and unmanned exploration.
Sources of information to support you with this Assignment	http://www.schoolsobservatory.org.uk/astro/stars/lifecycle http://imagine.gsfc.nasa.gov/educators/lesson_plans.html https://www.uwgb.edu/dutchs/AstronNotes/STARS.HTM